Electronic Services - Hayward, Ca
M21418X

OPERATING INSTRUCTIONS

MODEL TTS 100

MULTIPLE SELECTIVE DETECTOR UNIT

R. L. ARTMAN

NORTHEAST ELECTRONICS CORPORATION
AIRPORT ROAD
P. O. BOX 425 CONCORD, N. H. AREA CODE 603 224-7466

MODEL TTS 100 INSTRUCTION MANUAL

TABLE OF CONTENTS

SECTION 1 - General
2 - Transmission Performance
3 - Controls, Jacks, Switches and Lamps
4 - Circuit Description

Fig. 1 - TTS 100 Overall Schematic Diagram

Appendix - Automatic Gain Control Amplifier

General
Circuit Description
Performance
Level Range Adjustment

Fig. 1 - AGC Amplifier Schematic Diagram

Appendix - Selective Detector

General
Circuit Description
Performance
Sensitivity Adjustment

Fig. 1 - Selective Detector Schematic
Fig. 2 - Bandwidth Curves
Fig. 3 - Dial Pulse Distortion Curves

Appendix - TTS 100 KPMF Key Pulse Test Set

Operating Instructions

Fig. 1 - TTS 100XKPMF Adapter Schematic

MODEL TTS 100
MULTIPLE SELECTIVE DETECTOR UNIT

INSTRUCTION MANUAL

1.0 GENERAL

1.01 The Model TTS 100 Multiple Selective Detector Unit provides a group of selective detectors which are connected to a line on a bridging basis through an automatic gain control amplifier. The unit can be equipped with up to six selective detectors.

1.02 The TTS 100 is designed to operate as a subunit in loop around systems, voice frequency control systems, and other similar applications. When operated, a relay in the selective detectors applies ground to an output terminal; when released, it provides an open circuit on this terminal. The individual selective detectors may be adjusted to operate on any frequency in the voice frequency band. By means of strapping, the selective detectors may be made fast or slow operating; when strapped for fast operation, the selective detectors will follow standard dial pulses.

1.03 Monitor lamps are provided to supervise the operation of the individual detectors for testing purposes. Line input and AGC amplifier output jacks are provided to permit setting of the AGC amplifier control. One of the selective detector output circuits is brought out to a jack to provide a check of dial pulse transmission.

1.04 The TTS 100 occupies 7 inches of panel height; it requires 4 1/4 inches clearance to the front and 3 inches clearance to the rear. The TTS 100 is designed for mounting in either a standard 19 inch relay rack or in a TCC 20 portable carrying case. Adapters for 23 inch rack mounting are available on special order.

1.05 The TTS 100 operates from standard 48-volt station battery, requiring a maximum current of 0.5 amperes, exclusive of external adapter units. Overcurrent protection is provided by a 1 ampere fuse for the TTS 100; a separate fuse is provided for external equipment. The power switch controls both circuits.

1.06 Space is provided for a hold coil for applications requiring an OFF HOOK signal and terminals are provided for connecting a line termination across the input circuit as required.

1.07 If less than six selective detectors are mounted in the unit, additional detector units may be added by mounting the unit and connecting its cable to the proper points on a terminal board.

2.0 TRANSMISSION PERFORMANCE

Voice Circuit Insertion Losses, Transmission Levels, and Selectivity

2.01 TTS 100

The insertion loss of the TTS 100 is 0.1 db over a frequency range of 200 to 4000 cps. This loss is the result of the bridging loss of the AGC amplifier in a 600-ohm circuit.

2.02 AGC Amplifier

A. The automatic gain control amplifier in the TTS 100 performs two functions:

1. It provides a high bridging impedance of approximately 10,000 ohms, which is independent of frequency, to the line circuit, thereby maintaining a low bridging loss.
2. It supplies the tones received from the line, to the selective detectors at a nearly constant level, over the input level range described in the appendix. A screwdriver adjustment is provided for controlling the input level to the AGC amplifier.

B. For the specific performance data of the AGC amplifier see the attached appendix. As an example of the AGC performance in a specific TTS 20 system, the following data were obtained. With the LEVEL ADJ control set to approximately mid-range, the AGC amplifier provides gain control over a range of input levels from -12 dbm to -2 dbm. The selective detectors will continue to operate at levels down to approximately -22 dbm, leaving a safety margin of about 10 db beyond the lower

limit of automatic gain control. With a nominal send level of -2 dbm per tone, this permits operation over circuits having from approximately 0 db to 18 db transmission loss; i.e., an 18 db variation in loss. Operation at input levels other than -10 dbm, for instance, +2 dbm to -8 dbm, is accomplished by changing the setting of the LEVEL ADJ control, thereby changing the signal levels applied to the AGC amplifier input.

2.03 Selective Detectors

A. The selective detectors used in the TTS 100 are transistorized sub-assemblies, and, except for the component values used in the tuned circuit, they are identical. The time constants of these detectors may be changed by providing the proper "strapping" in the sub-assembly.

B. For the specific performance data of the selective detectors, see the attached appendix. As an example of the selective detector performance in a specific TTS 20 system, the following data were obtained. Since the input level applied to the selective detectors is held constant by the AGC amplifier over the 10 db range of levels as described in paragraph 2.02, the detector sensitivity controls are normally adjusted so that the operate and release points correspond to the 12 db points shown on the bandwidth curves (Fig. 2) in the Selective Detector Appendix.

In the case of lower input levels, the operate and release points are shifted correspondingly upward on the curves toward the 0 db or minimum operate point, thereby providing the previously mentioned safety margin of 10 db. When strapped for slow operation, the detectors will not respond to signals of shorter duration than approximately 1/4 second. This arrangement effectively prevents "talk-up" by voice signals on the line. When the detectors are used for dial pulse transmission, they are strapped for fast operation; in this case they are able to follow dial pulses at a pulse rate in excess of 25 cps.

[illegible], AND LAMPS

[illegible]

[illegible] of terminal board connections; however, to facilitate testing, [illegible]

1. [illegible] and tip leads of the input circuit.

2. AGC OUT - A type 310 jack bridged across the signal lead to the selective detectors. This permits a level measuring set to be used in conjunction with the gain control of the AGC amplifier.

3. [illegible] the F1 relay output lead. This jack disconnects any external equipment from the F1 relay, permitting direct measurement of selective detector dial pulse transmission performance.

Controls

1. LEVEL ADJ - This control adjusts the level of the tone signals applied to the AGC amplifier input.

[illegible]witches and Lamps

1. POWER ON - This switch controls all power to the TTS 100 [illegible]

2. LAMPS-OFF - This switch controls power to the monitor lamps associated with the selective detectors.

3. [illegible] detector unit. With the MONITOR LAMPS switch [illegible] detector is activated.

4.0 CIRCUIT DESCRIPTION

General

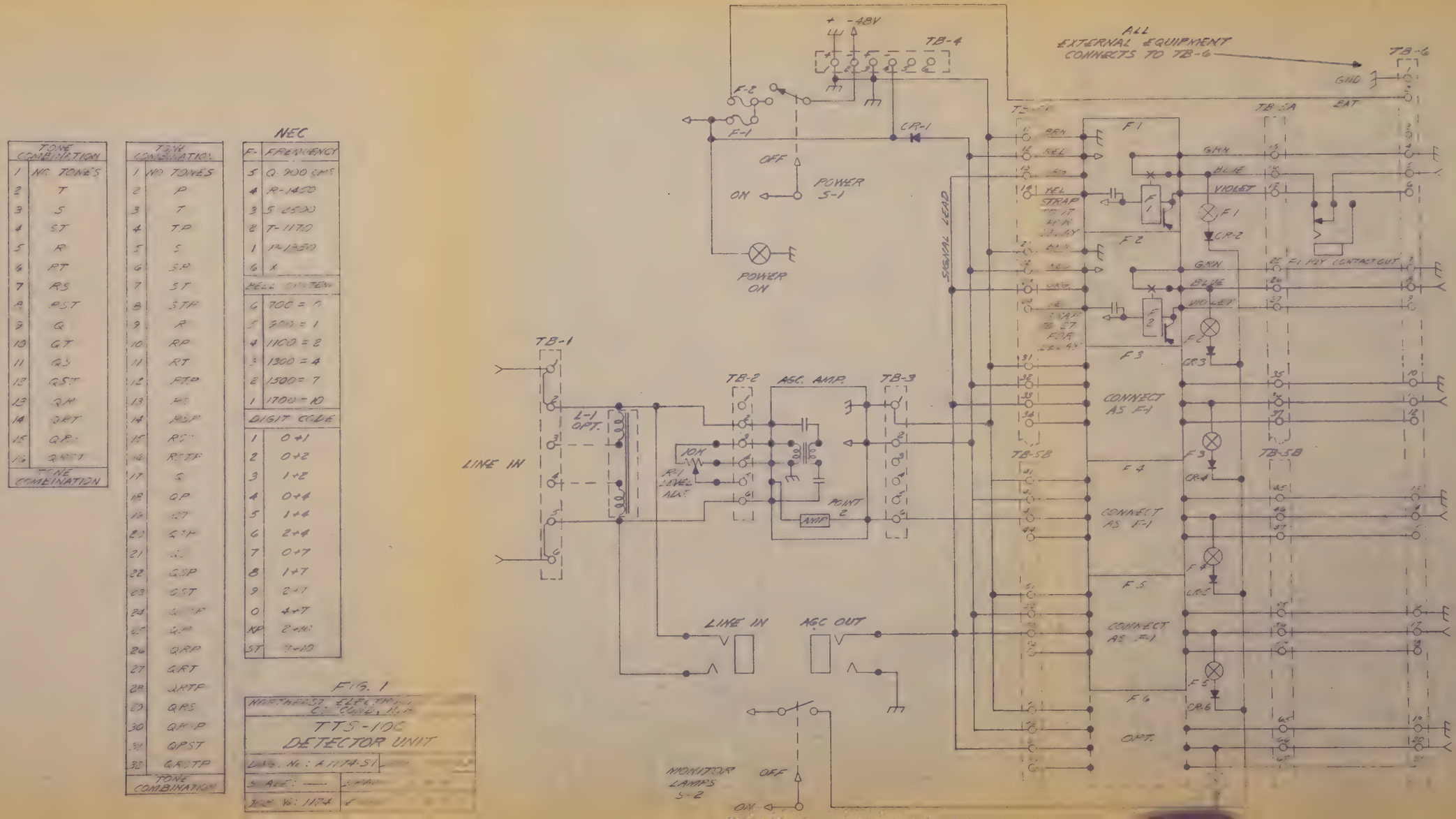
4.01 The TTS 100 Multiple Selective Detector unit (Fig. 1) consists of up to six selective detectors mounted on the front panel under a protective dust cover, an automatic gain control amplifier mounted on the rear of the panel under a protective panel, switches, lamps, and jacks for control and testing, and the necessary terminal strips for interconnections to external equipment and line connections. All external equipment is connected to TB-6 of the TTS 100.

4.02 The TTS 100 is designed to be used with additional equipment for specific purposes. For example, when it is interconnected with a TTS 23AC-11, these units become the TTS 23AC-1 Trunk Selector Control unit portion of the remote office equipment of a loop around test system; in this case, the TTS 100 would contain five selective detectors. If it is interconnected with a TTS 100XKPMF Key Pulse Multifrequency Test Adapter and mounted in a TCC 20 carrying case, these units become a portable test set for multifrequency key pulse dial systems. The TTS 100 would contain six detectors for this application.

4.03 Automatic Gain Control Amplifier - Voice frequency signals appearing on the line connected to terminals 1 and 6 of TB-1 in the TTS 100 are connected through a 9C blocking capacitor to the input transformer, T1, of the AGC amplifier. The input winding of T1 presents a high bridging impedance to the line. The operation, the circuit and the performance of the AGC amplifier are described in detail in the attached AGC appendix. The AGC amplifier has a low output impedance to permit direct parallel connection of the selective detectors which are driven by it.

4.04 Selective Detectors - The level-regulated voice frequency signals appearing on the output of the AGC amplifier are used to drive the selective detector units. The selective detector units have a high bridging impedance. Each unit is equipped with a sensitivity control which is accessible after the dust cover is removed. The operation, circuit description, and performance of the selective detectors are described in the attached Selective Detector Appendix. Each selective detector contains a relay which applies ground to a terminal on TB-6 whenever the selective detector is operated; an open circuit is presented when the selective detector is not energized.

4.05 Test Provisions - By putting an input signal in the LINE IN jack and a level meter in the AGC output jack, the operating range of the AGC amplifier can be adjusted to cover the desired level range; this adjustment is made by means of the AGC level control which is mounted on the front panel. In addition, the front panel contains a jack which permits measurement of the pulse signals generated by the relay in the F1 selective detector. By inserting a keyed voice frequency signal in the LINE IN jack and a TTS 26 or equivalent PERCENT BREAK meter in the F1 RELAY CONTACT OUT jack, the pulsing performance of the F1 selective detector can be tested. In addition, lamps are provided in parallel with each selective detector output circuit. For testing purposes, these lamps are activated by means of a turn-button switch; in this condition, the operation of each individual detector may be checked.


TONE COMBINATION
1 NO TONES
2 T
3 S
4 ST
5 R
6 RT
7 RS
8 RST
9 Q
10 QT
11 QS
12 QST
13 QR
14 QRT
15 QRS
16 QRST
TONE COMBINATION
TONE COMBINATION
1 NO TONES
2 P
3 T
4 TP
5 S
6 SP
7 ST
8 STP
9 R
10 RP
11 RT
12 RTP
13 RS
14 RSP
15 RST
16 RSTP
17 Q
18 QP
19 QT
20 QTP
21 QS
22 QSP
23 QST
24 QSTP
25 QR
26 QRP
27 QRT
28 QRTP
29 QRS
30 QRSP
31 QRST
32 QRSTP
TONE COMBINATION
NEC
F- FREQUENCY
5 Q 900 CPS
4 R-1450
3 S 2600
2 T-1170
1 P-1450
6 X
MELL SYSTEM
6 700 = 0
5 900 = 1
4 1100 = 2
3 1300 = 4
2 1500 = 7
1 1700 = 10
DIGIT CODE
1 0+1
2 0+2
3 1+2
4 0+4
5 1+4
6 2+4
7 0+7
8 1+7
9 2+7
0 4+7
KP 2+10
ST 7+10
FIG. 1
NORTHERN ELECTRIC CO. LIMITED
TTS-10C
DETECTOR UNIT
LAB. No: A 1174-S1
SCALE: —
DRAWN No: 1174
+ -48V
TB-4
F-2
F-1
CR-1
OFF
ON
POWER S-1
POWER ON
SIGNAL LEAD
ALL EXTERNAL EQUIPMENT CONNECTS TO TB-6
TB-6
GND
BAT
TB-5A
TB-5B
F1
F2
F3
F4
F5
F6
OPT.
CR-2
CR3
CR4
CR5
CR6
GRN.
BLUE
VIOLET
YEL
BRN
CONNECT AS F-1
F1 MAY CONTACT OUT
TB-1
TB-2
TB-3
ASC. AMP.
L-1 OPT.
LINE IN
10K
R-1 LEVEL ADJ.
POINT 2
AMP
LINE IN
AGC OUT
MONITOR LAMPS S-2
OFF
ON

AGC AMPLIFIER APPENDIX

General

The AGC amplifier is located on the rear of the TTS 100 panel. Its purpose is to supply the voice-frequency signals received from the line, to the selective detectors input at a nearly constant level, thereby maintaining an optimum bandwidth adjustment of the selective detectors over a 10 db range of levels, adjustable with the LEVEL ADJ control. The amplifier has been designed so that the bridging loss, caused by its insertion into the loop around circuit, is negligible. The amplifier is shown schematically on Fig. 1.

Circuit Description

Voice frequency signals appearing on the line connected to terminals 1 and 6 of TB-1 in the TTS 100 are coupled through DC blocking capacitor C100 to the base of voltage amplifier transistor, Q101. The amplified signal seen at the collector is coupled through C101 to the base of emitter follower transistor Q102 which provides the current gain necessary to drive the combination AGC and output transistor Q103. Signals appearing at the base of transistor Q103 from C102 are amplified and coupled through C130 to the output terminal "2" from the junction of the collector load resistance R108 and thermistor TH-1. Automatic gain control of this stage is achieved in the following manner.

AC voltage appearing across the emitter load resistor R107 of transistor Q103 is applied through capacitor C103 to amplifier transistor Q104 which drives a conventional voltage doubling rectifier circuit consisting of capacitor C104, diode D101, diode D102, and capacitor C105. The output of this circuit is a DC voltage that becomes more negative as the output level of

transistor Q103 increases. This voltage is applied to the base of transistor Q103 through diode D103, completing a "positive feedback" loop.

Thus it is seen that as the output level increases, the DC feedback voltage to the base of transistor Q103 becomes more negative thereby increasing the current flow through transistor Q103 and through resistor R108 and thermistor TH-1 in the collector lead of transistor Q103. The resultant increased internal heating of TH-1 lowers the resistance to ground from the junction of R108 and TH-1. Since R108 and TH-1 form a variable voltage divider from which the output signal is taken, a nearly constant level is present at point Z over the range of AGC amplifier input level variations specified above.

Thermistor TH-2 provides temperature compensation for the bias of transistor Q103; thus proper operation of this circuit over a wide temperature range is realized. Diode D103 is utilized for its "Fermi" characteristics and prevents AGC action from starting at very low levels. The output signal is applied to the selective detectors in parallel from point "Z".

Performance

The AGC amplifier has an overall gain of approximately 26 db, measured from the line input of the amplifier to the output at point "Z" in the schematic or the AGC OUT jack. The minimum signal level for proper operation of the selective detectors, factory adjusted as described in the selective detector appendix, is -7.5 dbm or 1 volt peak-to-peak. With the LEVEL ADJ control set to minimum attenuation, an input signal at -33 dbm will meet this requirement. In this condition, automatic gain control is inoperative. AGC action begins with an 8 db increase in level and continues through an additional 19 db of signal increase. Normal factory setting of the LEVEL ADJ control is -7.5 dbm (1V p-p) at point "Z" with an input signal at -52 dbm.

With the LEVEL ADJ control set in this manner, the amplifier will provide AGC action over an input level range of -12 dbm to -2 dbm; the AGC output remains at +2 dbm ±1 db over this range. The input level may rise to +1 dbm ±1 db before amplifier overload occurs and the resulting waveform distortion appears in the output signal.

Maximum signal level input is not specified since the LEVEL ADJ potentiometer controls the portion of the signal which appears on the amplifier input. At very high levels the setting of this potentiometer becomes critical.

Level Range Adjustment

With the TTS 100 operating, insert a single frequency signal of 1000 cps to 1500 cps through a type 310 plug into the LINE IN jack on the TTS 100 front panel. Adjust the level of this signal to equal the minimum anticipated level; however, do not go below -18 to -34 dbm without readjusting the selective detector units as described in the Selective Detector Appendix, adjustment paragraph.

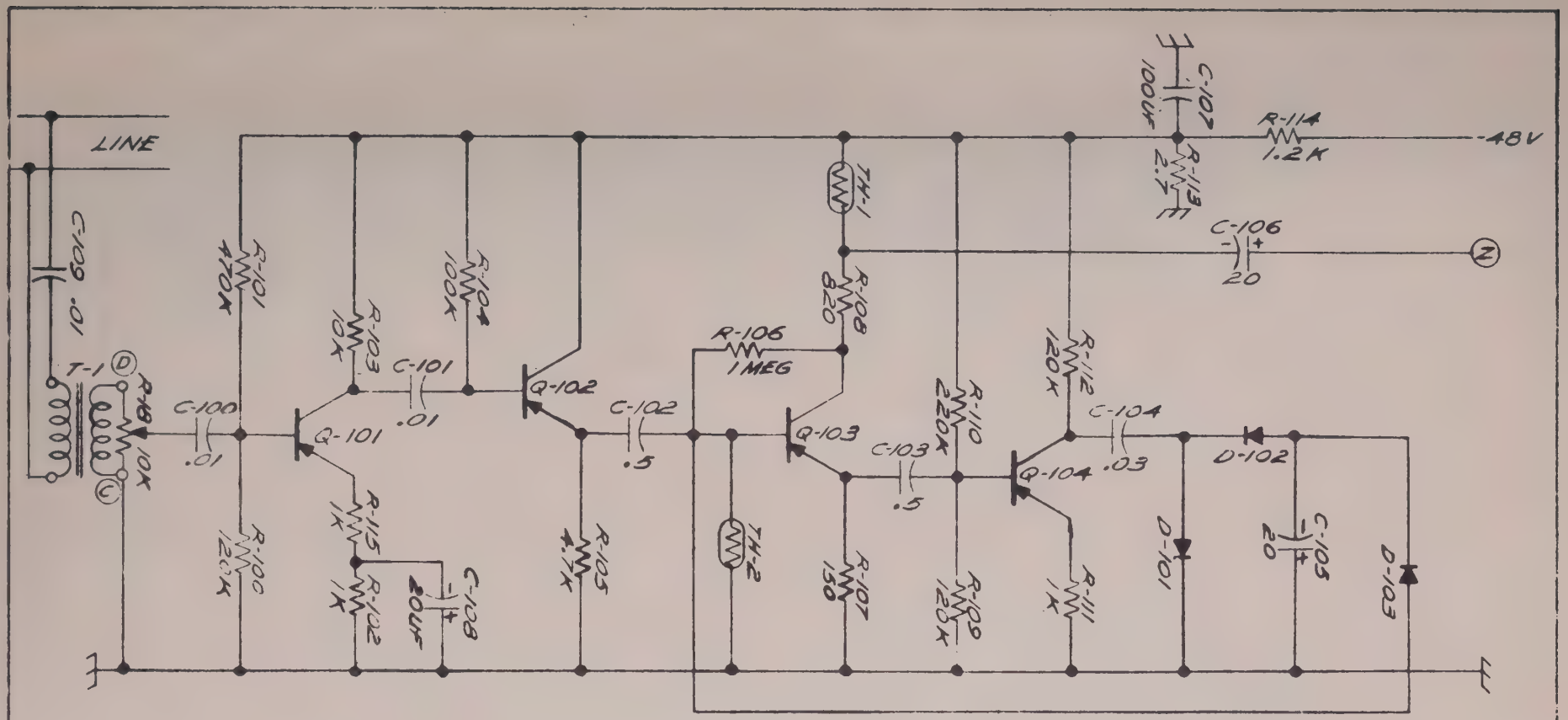
Connect a level meter calibrated for db in 600 ohms or an oscilloscope to the AGC OUT jack through a type 310 plug (the tip is ground and the ring is the signal lead). Loosen the locking nut and adjust the LEVEL ADJ potentiometer until a reading of -7.5 dbm (0.3 dbm is obtained, or a 1 volt peak-to-peak waveform is observed on the scope, and tighten the potentiometer lock nut. This completes the adjustment procedure.

The amplifier is normally factory adjusted in this manner with a signal input level of -22 dbm for use with loop around systems, and -16 dbm for use with key pulse multifrequency tests.

If the maximum anticipated signal level is more than 22 db above the minimum, amplifier overload will occur, and the output will be distorted; in this case a compromise setting must be made.

The output level of the amplifier, with automatic gain control operating, is a factory setting and not adjustable in the field.

AGC amplifiers with higher gain, output, or larger control ranges are available on special order.



NOTE:
ALL RESISTORS ½ WATT ± 10%
TH-1 = 2 WE #D-164699
TH-2 = VEC #43R1
Q-101 THRU Q-104 #2N1375
D-101 THRU D-103 SYLVANIA #1N198

SCHEMATIC
AGC AMPLIFIER CIRCUIT

FIG. 1

APPENDIX

SELECTIVE DETECTOR

General

The selective detector units operate when a voice frequency signal of the proper frequency is applied to their input. The individual detectors may be adjusted to operate on any frequency within the voice frequency band. When operated, the detectors close a relay contact which applies ground to the output terminal of the selective detector; in the released condition an open circuit appears on this terminal. By means of strapping, the detectors may be made fast or slow operating; when strapped for fast operation, the detectors will follow pulses in excess of 25 pulses per second.

Circuit Description (Fig. 1)

The individual selective detector units consist of four transistor stages each. The input stage, Q1, is a conventional emitter follower utilized to maintain a reasonably high input impedance. Transistor Q2, the second stage, is a conventional common emitter amplifier utilized to achieve voltage gain. Transistor Q3 is an emitter follower utilized to provide high impedance coupling between the output stage, Q4, and the amplifier stage Q2. Transistor Q4 drives the relay within its collector circuit according to the control signals as they are received at the input of the selective detector.

The input signal is coupled to the base of transistor Q1 from the point marked "2" in the output of the AGC amplifier

through sensitivity control R16, capacitor C1, and resistor R1. The output of transistor Q1 is taken from the emitter, and coupled through capacitor C2 to the base of transistor Q2. The amplified signal seen at the collector of Q2 is coupled directly to the base of transistor Q3; output is taken from the emitter of Q3 and applied to a voltage coupling rectifier circuit; simultaneously this output is coupled through R17 and capacitor C5 to the frequency selective network consisting of inductor L1, capacitors C3 and C4, resistors R7, R8, R15, and thermistor TH-1. The output of this network is applied directly to the base of transistor Q1, thus completing a negative feedback loop. The values of R7, C3, and C4 are selected in accordance with the frequency to which the detector is to respond.

The bridged-T frequency selective network has the characteristic of passing through it all frequencies except a narrow band which is centered about the specific frequency to which it is tuned. Therefore, off-frequency signals are coupled back to the base of transistor Q1, and the gain of amplifier stages Q1 and Q2 is reduced to a level far below that required to operate the relay within the output stages.

When the frequency of the input signal falls within the narrow band, approaching the tuned frequency, the network reduces the feedback level proportionately until such time as the frequency is exactly correct; at this point the feedback is completely removed, and the gain of amplifier stages Q1 and Q2 rises to maximum.

At some point during the above, transistor Q3 will provide an output signal to the voltage doubling rectifier circuit, consisting of C6, CR1, CR2, and C7, which is sufficient to cause transistor Q4 to conduct, thereby energizing relay K1 in its collector circuit. The value of capacitor C7 has been selected to provide a certain amount of storage for the signal applied to the base of transistor Q4, and yet allow this stage to follow dial pulses; it is therefore important not to substitute other values for this capacitor.

The network consisting of capacitor C8, resistor R11 and diode CR3, when strapped across the relay coil (this is done externally by strapping the violet and yellow leads together on the terminal board connections associated with this particular detector), provides a delay of approximately 1/4 second on energizing, thus preventing the detector from responding to short bursts of noise such as talking, line noise, etc. Diode CR3 permits relay K1 to release immediately upon the removal of the input signal; in other words the time delay provided by the 200 microfarad capacitor C8 when Q4 switches on is effectively removed when transistor Q4 returns to the "off" condition.

Operating voltage for the selective detector units is obtained from 48-volt station battery through the voltage divider and filter networks consisting of R13, C9, and R14. One such voltage divider and filter is located on each selective detector unit.

Performance

With the sensitivity control, P16, set to maximum sensitivity, the detector will just operate with an input level of -18 dbm applied to its input. The normal factory adjustment is to have the detectors just operate with an input of -7.5 dbm (1 volt peak to peak). The AGC amplifier, with its gain control operating, supplies a level of approximately -2 dbm to the selective detector input; this results in a bandwidth of from + to + 1/2% of the operating frequency when the sensitivity is adjusted as above. Bandwidth curves for a representative selective detector, showing operate and release frequencies as a function of input level, are given in Fig. 2. Dial pulse distortion curves, showing output % break as a function of input level and as a function of input % break are given in Fig. 3.

Sensitivity Adjustment

With the TTS 100 operating, insert a signal exactly at frequency F1 through a type 310 plug into the LINE IN jack on the TTS 100 front panel. Connect a level meter calibrated for db in 600 ohms or an oscilloscope to the AGC OUT jack through a type 310 plug (tip is ground, ring is signal lead) and adjust the signal input level until a reading of -7.5 dbm is obtained or a 1 volt peak-to-peak waveform is observed. Do NOT use the LEVEL ADJ control for this purpose unless a subsequent AGC amplifier adjustment is to be made.

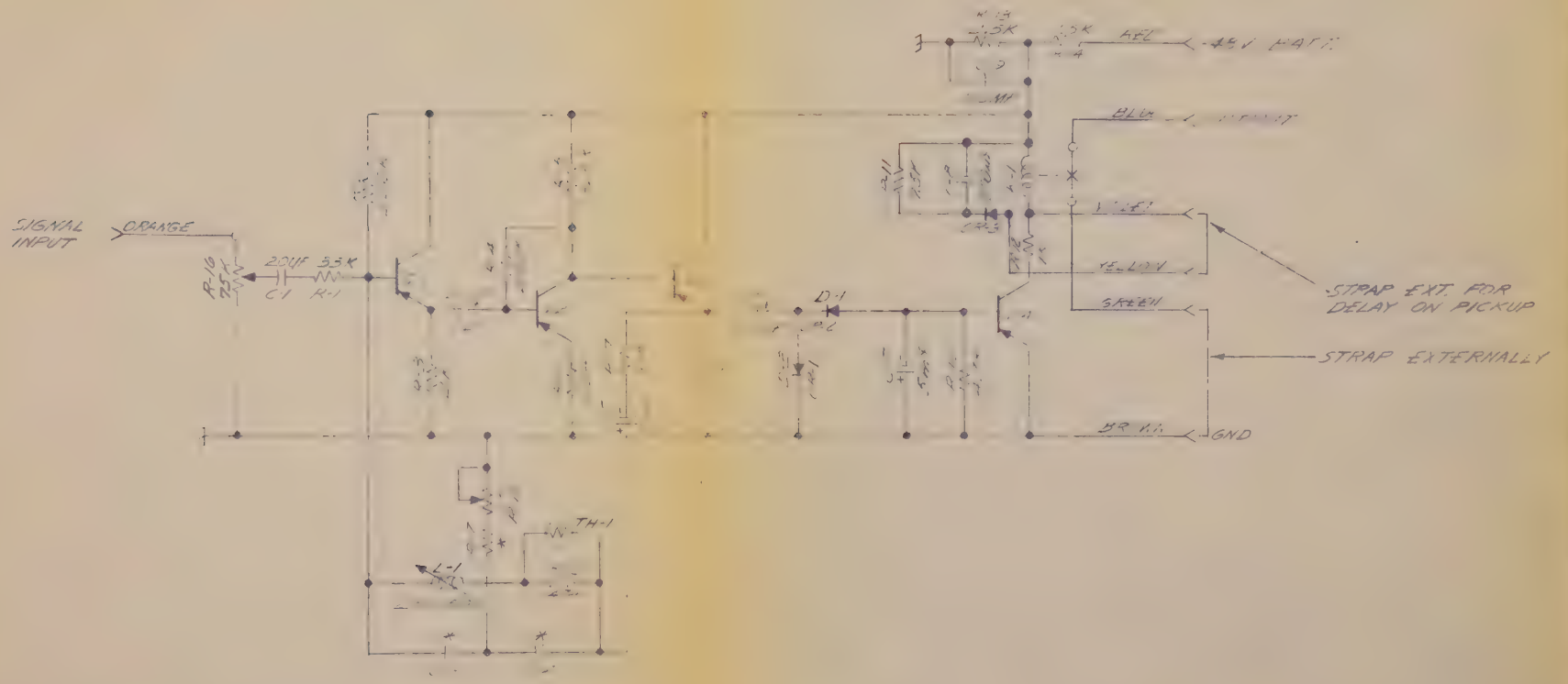
Remove the front panel dust cover, and rotate the F1 selective detector sensitivity control potentiometer fully clockwise (the F1 selective detector is located at the right of the TTS 100 panel). Rotate the MONITOR LAMPS switch to the ON (up) position. Now slowly turn the potentiometer counter-clockwise until the F1 lamp lights and remains lit. Interrupt the input signal momentarily and observe that the F1 lamp goes out and relights within 1/2 second after the signal is restored. If it does not, a slight advance of the control will normally be sufficient to insure operation.

Change the input signal frequency to exactly F2 (note that the level remains -7.5 dbm; adjust if necessary), and rotate the F2 detector (second from right) sensitivity control fully clockwise. Again, slowly turn the F2 control counter-clockwise until the F2 lamp lights, following the procedure as outlined for F1.

Proceed in this manner through each of the selective detectors. This completes the adjustment procedure for normal operation.

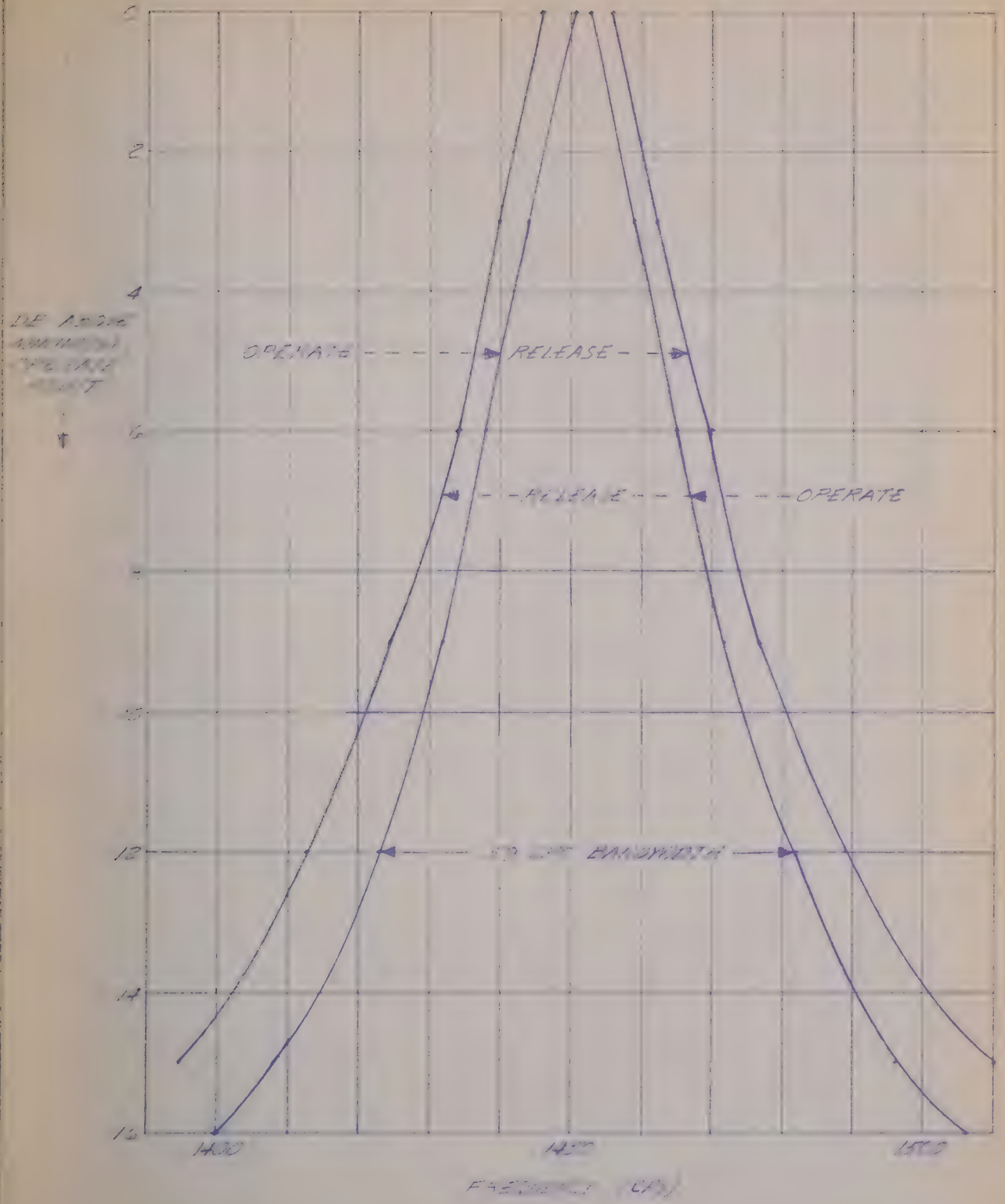
If the TTS 100 is to be used with circuits where minimum levels down to approximately -40 dbm are expected, the detectors may be adjusted to just operate with the minimum level applied to the LINE IN jack, and the LEVEL ADJUST control fully clockwise; however, under these circumstances, if the maximum level is 24 db above the minimum expected level, the AGC amplifier will overload; a compromise setting must be made in this case.

REVISIONS			SIZE	REV
			CONT ON SHEET	SH NO
SYM	DESCRIPTION	DATE	APPROVAL	
1	MINOR CHANGES	8-16-63	L. B. G.	
2	DELETED R-17, 100Ω; ADDED R-17, 10K	9-27-63	L. B. G.	

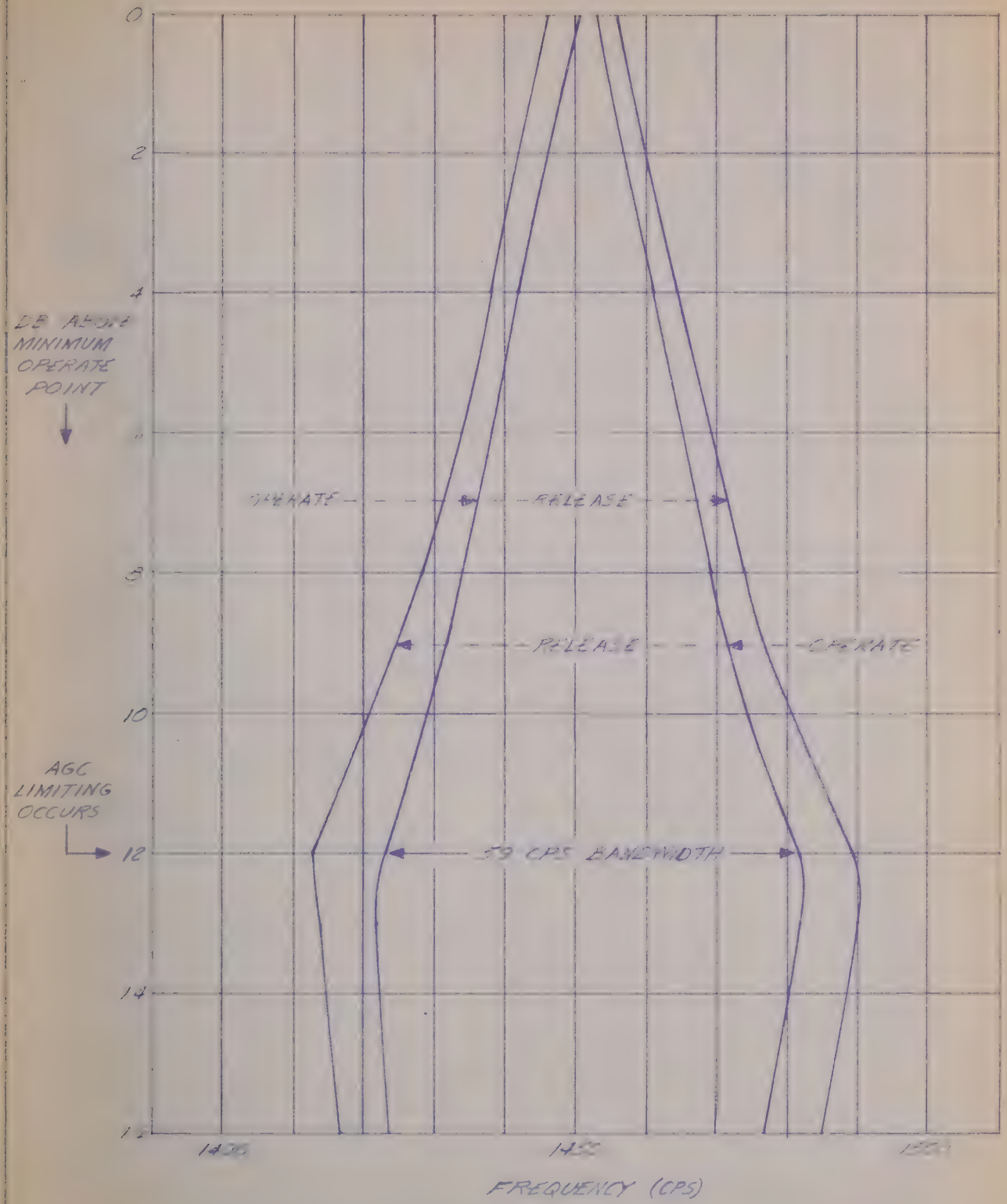


NOTES:
1. TRANSISTORS ARE 2N1375 (T1)
2. * SELECTED VALUES
3. K-1 RELAY MAY BE A SIGMA 11F OR CLAREED CP2-1056

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ±1/64 DECIMALS ±.005 ANGLES ±½° ALL SURFACES	DRAWN K.A. SMITH	SCHEMATIC SELECTIVE DETECTOR	NORTHEAST ELECTRONICS CORP. CONCORD, N. H.
MATERIAL	DATE 7-24-63		REF NO S-1
	APPD		SIZE B
FINISH	ISSUED		
PAINT	APPROVED / DATE		
SCREEN PER	ENGR		
	MFG		
	SCALE	WT CALC ACTUAL	CONT ON SHEET / SH NO



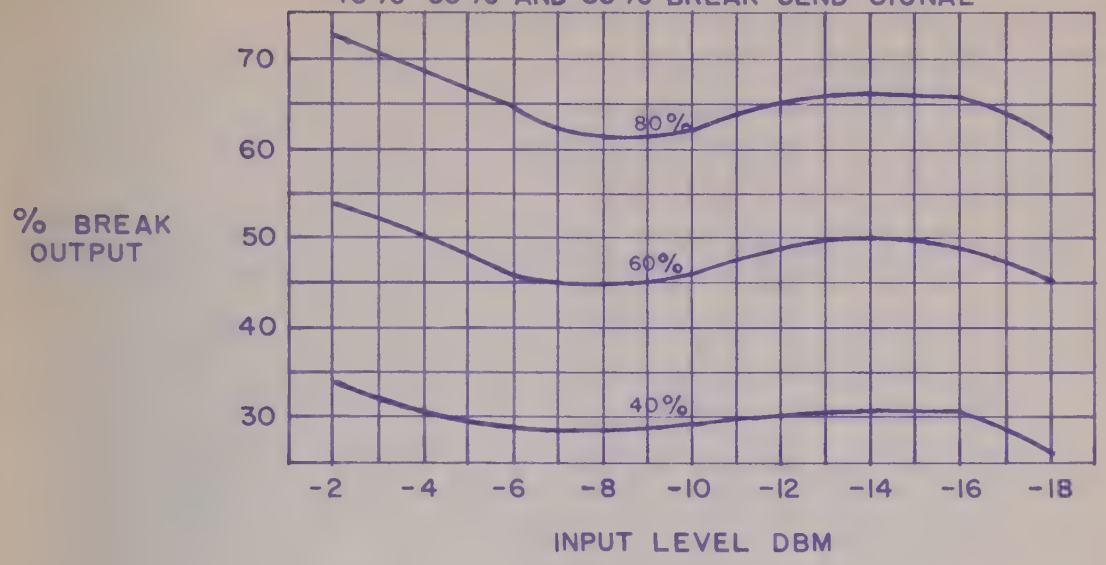
SELECTIVE DETECTOR UNIT
FREQUENCY RESPONSE
(WITHOUT AGC AMPLIFIER)



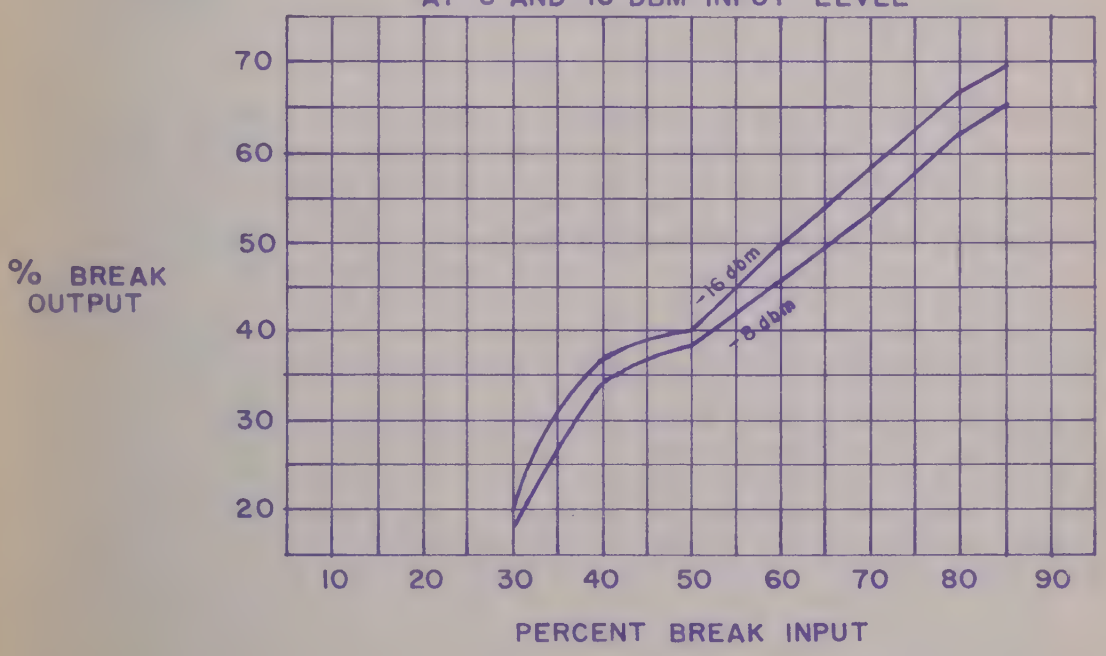
SELECTIVE DETECTOR UNIT
REPRESENTATIVE BANDWIDTH
(WITH AGC AMPLIFIER)

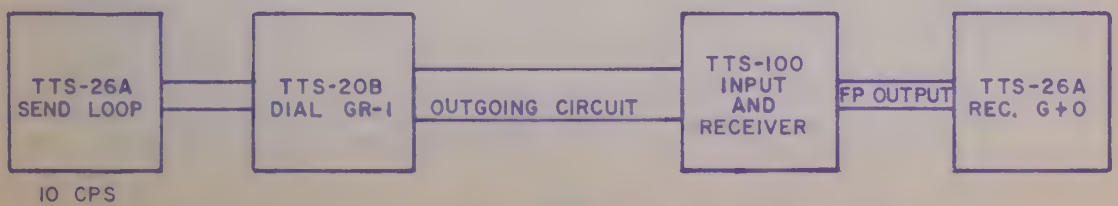
FP DETECTOR OUTPUT

PERCENT BREAK OUTPUT VS INPUT LEVEL FOR
40% 60% AND 80% BREAK SEND SIGNAL



PERCENT BREAK OUTPUT VS PERCENT BREAK INPUT
AT -8 AND -16 DBM INPUT LEVEL





SELECTIVE DETECTOR
REPRESENTATIVE DIAL PULSE DISTORTION

FIG. 3

APPENDIX

MODEL TTS 100KPMF

KEY PULSE MULTIFREQUENCY TEST SET

OPERATING INSTRUCTIONS

1. Open and remove front cover. The test set will operate either vertically or horizontally as desired.

2. Operate the TTS 100 POWER switch to OFF (down).

3. Rotate the LAMPS-OFF switch to the ON (up) position.

4. 48V station battery is connected to the TTS 100 through a type 310 plug inserted into the jack on the left mounting rail of the TCC 20 Carrying Case next to the TTS 100 Detector unit. This jack is wired with the ring and sleeve common for positive (ground) and the tip for -48V, and is marked accordingly.

   CAUTION: Insert the plug into the TCC 20 before connecting the other end to battery to avoid possible short circuits.

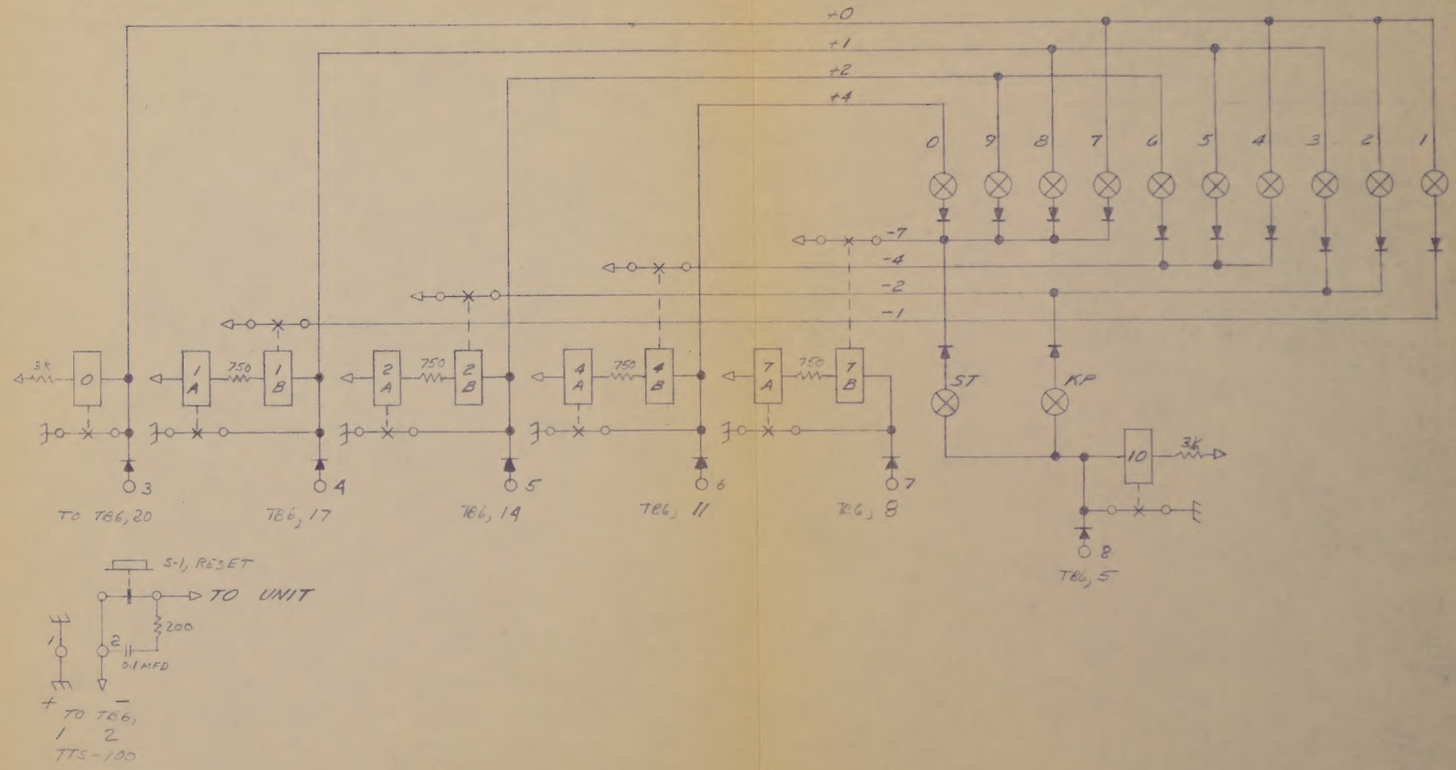
5. The circuit under test is connected to the TTS 100 through a type 310 plug inserted into the jack marked LINE IN. This is a bridging connection to the circuit under test. If a termination is required on certain tests, it should be connected externally; a permanent termination may be connected across terminals 2 and 6 of TB-2, TTS 100.

6. Operate the POWER switch to the ON (up) position. Note that the green lamps F1 through F6 on the TTS 100 panel will light and then go out and that the yellow digit indication lamps on the XKPMF adapter panel will all light and remain lit until the RESET button is depressed. This action provides a lamp test function, a test of the adapter panel, and a check of battery polarity. In the case of reversed power connections, only the red POWER lamp will light. If the green test lamps light, but no yellow lamps are lit, the adapter panel is not receiving power (check F2 and the RESET button).

7. The test set is now ready to receive voice-frequency key pulse signals. Note that two green lamps will flash momentarily (if the LAMPS switch is ON) as the signal is received and that the corresponding 2-out-of-6 code yellow digit indication lamp will remain lit until the RESET button is depressed. Refer to Fig. 1, TTS 100 Overall Schematic Diagram, for list of digit codes, Bell System frequencies, and NEC F-numbers.

8. The test set is factory adjusted for operation with input levels of from -2 dbm to -16 dbm, corresponding to the nominal multifrequency send levels of -2 dbm per tone (-6 dbm in some areas); other level ranges are obtained by adjustment of the LEVEL ADJ control as described in the AGC amplifier appendix to the instruction manual, adjustment paragraph.

CC/scl
7/10/63



A 1174-54
FIG 1

NORTHEAST ELECTRONICS CORP. CONCORD, N.H.	
TTS-100 XKPMF MULTIFREQUENCY TEST ADAPTER	
DWG. NO.	DATE: 6-3-63
SCALE: ~~	DRAWN: L.B.G.
JOB NO:	ENGR: C.B.C.